DETERMINATION OF THE PARAMETER s

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ABSTRACT. Experimental data for determining the parameter s, characterizing the distribution of meteoric bodies in terms of mass, are presented.

This paper presents experimental data for determining the parameter s characterizing the distribution of meteoric bodies in terms of mass, obtained by an SOM-1 radar during 1964-1965. The equipment, and the procedure involved in the observation of meteoric activity, are described in reference [1, 2]. /68

The parameter s was determined from [3]:

$$s = 1 + \frac{4}{3} \frac{\ln \frac{N_1}{N_2}}{\ln \frac{\tau_2}{\tau_1}}, \quad (1)$$

where

N_1 is the number of meteors with duration $\tau \geq \tau_1$;

N_2 is the number of meteors with duration $\tau \geq \tau_2$.

Reflections with durations longer than 10 seconds were excluded.

Meteor echoes with durations $\tau_1 \leq 0.2$ sec and $\tau_2 = 0.4$ sec were used for the calculation to ascertain the behavior patterns in the change in the parameter s over a 24-hour period, from day to day, and over a period of a year. Then s can be found from

$$s = 1 + 1.972 \ln \frac{N_1}{N_2}, \quad (2)$$

where

N_1 is the number of meteors whose duration exceeds τ_1;

N_2 is the number of meteors whose duration exceeds τ_2.

The meteor data, taken from film, were transferred to punched tape and processed by a "Minsk-1" type all-purpose digital computer.

Figure 1 shows the results of the determination of the parameter s for

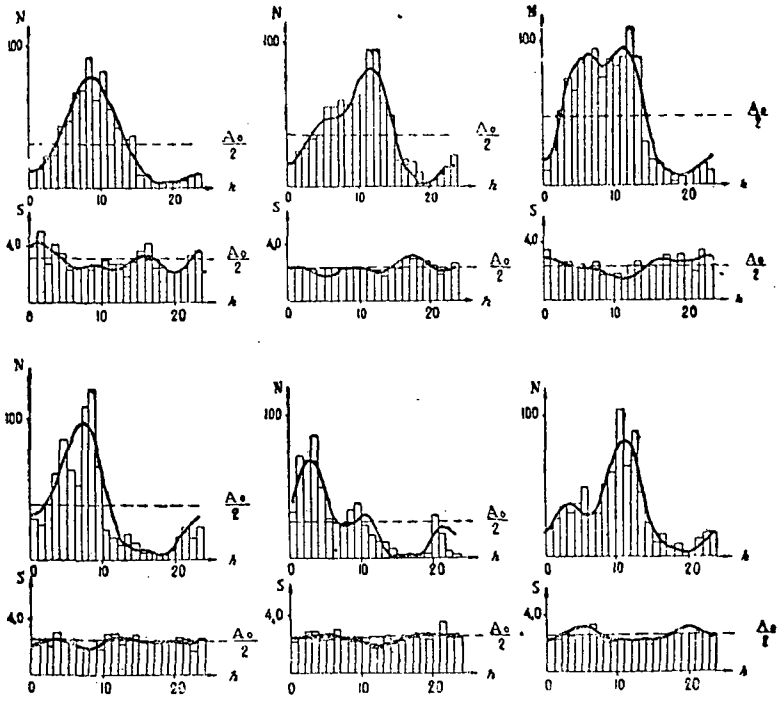

Figure 1. Values of parameter s for 1964-1965.

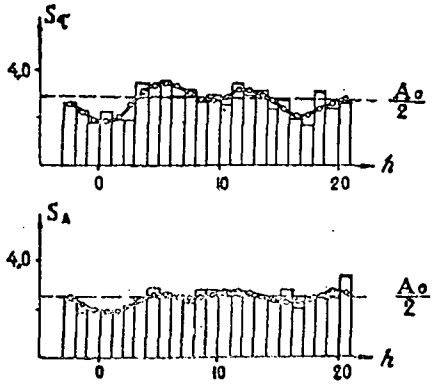

Figure 2. Daily changes in parameter s.

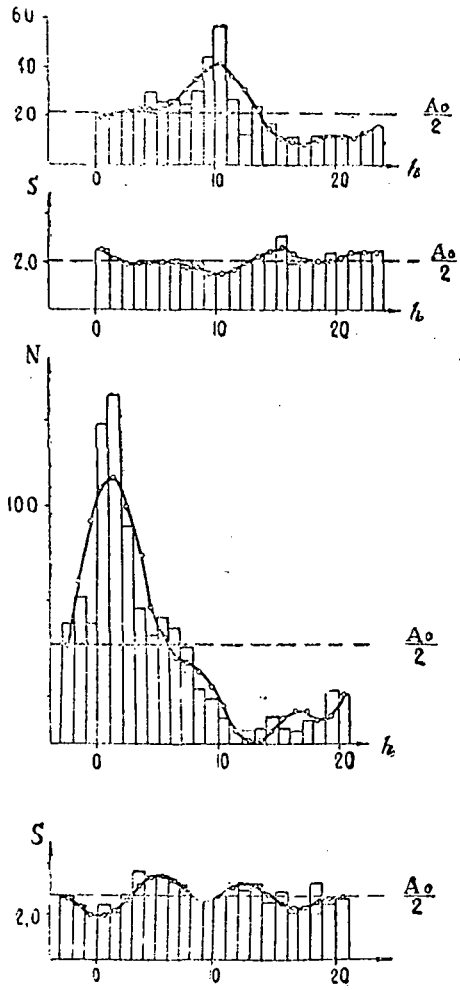

Figure 3. Values of the parameter s calculated for meteor streams.

1964-1965. Determination of the parameter s in terms of amplitude-time characteristics is more precise [4, 5], so s was measured using /70

$$s = 1 + k \ln \frac{N_1}{N_2}, \qquad (3) \qquad /71$$

where

N_1 is the number of meteors whose amplitudes exceed the threshold level A_1;

N_2 is the number of meteors whose amplitudes exceed the threshold level A_2;

k depends on the levels of the A_1 and A_2 readings.

The "Minsk-1" computer was used to process these data as well.

Figure 2 histograms show the determination of s by two methods, and are presented for purposes of comparison. These histograms show that the parameter s has a daily pattern. The amplitude of the first harmonic is small ($A_1 = 0.5$), but distinguishable. Accuracy in determining s is of the order of 60%. This indicates the inhomogeneity of meteor material distribution along the celestial latitude.

The parameter s has a tendency to decrease during the activity of apex and solar maxima. Possibly this indicates a difference in the structure of the sporadic meteor background.

Figure 3 shows the results of determining s for several streams. There is a reduction in s with increase in number, but with some delay. The dip in s in the time interval $h_1 - h_2$ can indicate a concentration of larger particles. The distribution of meteoric material in streams can be studied using this method. The time delay between the number maximum and the s minimum apparently indicates the Poynting-Robertson effect. More detailed and longer radar observations of meteor streams will aid in the evaluation of the influence of the Poynting-Robertson effect on the evolution of meteor stream orbits.

Conclusions

1. The daily pattern of the parameter s indicates the heterogeneity of meteor material with respect to the celestial latitude.

2. A decrease in s is observed in the region of apex and solar maxima. This may indicate a difference in the structure of the sporadic background in the apex and solar directions.

3. The study of the parameter s can help in explaining the distribution of meteor material and in evaluating the influence of the Poynting-Robertson effect for streams.

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